SERVICE DEPARTMENT

DLS 90

Service Manual

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Consultronics

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DLS 90

Calibration Verification Procedure

Version 1.02
January 26, 1995

Consultronics

OPERATING AND REFERENCE MANUAL

DLS 90

ADSL Wireline Simulator

Consultronics

Rev.3 (October 21, 1994)

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Section 1 INTRODUCTION

1.1 About this Manual

The **DLS 90 Operating Manual** can be used to learn about the unit for the first time, or can be used as a look up reference book. We suggest that you carefully read the introduction sections of this manual before powering on your unit.

If you still have questions after reading this manual, please contact your Consultronics sales representative or our customer service department at the location shown in section 4, "Warranty" of this manual. If you have any suggestions as to how this manual could be improved, please write to us at the same address.

Thank you for your business and for choosing **Consultronics**.

1.2 Receiving and Unpacking the Unit

The DLS 90 has been shipped to you in a reinforced cardboard shipping container. We recommend that you retain this carton for any future shipments.

Please check that you have received all the items as per the packing list and report any discrepancies as soon as possible. Please also note that some options are installed within the chassis of the main unit and can only be checked by powering on the unit.

The DLS 90 supports many AC voltages found in various parts of the world. We have already selected the voltage appropriate to your country according to the information we had. But errors do occur... so read section 2.1 "Powering on the DLS 90" before switching on the DLS 90.

1.3 DLS 90 Overview

The DLS 90 simulates a 2 wire length of cable up to frequencies of 1.5 MHz and provides usable simulation up to 2 MHz. The user can easily change the length of the simulated cable by using the front panel of the DLS 90 or via a computer. It is meant to be used in laboratories and production lines to simulate "real life" wireline situations on bench top.

The DLS 90 can be ordered with 6.35 kft or 9.35 kft in 24 or 26 AWG, and 0.4mm PE line to 3 km.

The devices under test are connected to the DLS 90 using either the RJ-45 connectors or the terminal block, located at the front or at the back. All the connectors on each side are connected in parallel.

The unit can be controlled via the IEEE 488 and the RS-232 serial interfaces. One simple command is all that is needed to set the channel length, but other IEEE 488.2 and SCPI commands are also supported.

Section 2 OPERATION

2.1 Powering On the DLS 90

Before switching on the DLS 90, verify that the line voltage selection shown at the back of the unit corresponds to the local line voltage. If it is different, then do the following:

- remove the power cord
- open the fuse box cover in the power module at the back using a small flat screwdriver
- pull the voltage selector card
- turn the plastic knob until you have selected your local power voltage
- put everything back together
- check that the white dot is now beside your local line voltage.

The DLS 90 can use either the one fuse configuration or the two fuses configuration. It is normally shipped with the 1 fuse arrangement. When the customer or regulation require, this can be changed to the 2 fuse arrangement. To change the fuse configuration, do the following:

- remove the power cord
- open the fuse box cover in the power module at the back using a small flat screwdriver
- remove the screw holding the fuse holder
- turn it around
- install the fuse(s)
- reassemble

To operate the DLS 90, connect the unit to the power source, and turn on the unit. There will be a short disconnection at power up while performing the self-test.

One convenient feature of the DLS 90 is that the last configuration used is kept latched into the relays, allowing the unit to be used even when the power is turned off. As an option, the wireline length may be restored or reset to zero.

2.4 Configuring the DLS 90

Pressing both the Left and Right arrow keys at the same time gets into the unit setup menus, where some of the operational characteristics of the unit can be changed.

The user can move among the different fields using the Left and Right arrows. The Up and Down arrows will change the setting of the selected feature. On any of the setting screens, pressing both Left and Right arrow keys at the same time returns to the main screen.

Fig. 2.2 LCD Contrast

To change the contrast of the display use the following steps:

- From the main screen, press both the left and right arrows simultaneously.
- Use the up and down arrows to select the desired contrast.
- Press the left and right arrows simultaneously to return to the main screen.

The contrast value is saved in non-volatile RAM, and will be restored on power up. The default contrast is 7.

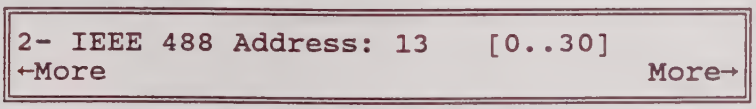


Fig. 2.3 IEEE 488 Address

To change the IEEE 488 address of the DLS 90 use the following steps:

- From the main screen, press both the left and right arrows simultaneously.
- Press the right arrow once to get to the IEEE 488 Address screen.
- Use the up and down arrows to select the desired address.
- Press the left and right arrows simultaneously to return to the main screen.

The address is saved in non-volatile RAM, and will be restored on power up. The default is 13. See section 3.1 for more details.

Section 3 REMOTE CONTROL

The DLS 90 can be remote-controlled via the IEEE 488 (also known as the GPIB bus) and RS-232 (serial) interface, allowing the integration of the DLS 90 into a larger test system.

The DLS 90 remote control is designed with several standards in mind:

- The GPIB physical interface follows IEEE 488.1. The functions implemented are outlined in Section 3.1 "IEEE 488 Interface".
- The Common Commands follow IEEE 488.2.
- The Device Dependent Commands (see Section 3.7) are based upon the Standard Commands for Programmable Interfaces (SCPI). However, we had to create some device dependant commands since there was no pre-defined SCPI command that could apply to the DLS 90.
- The serial port physical interface follows the EIA RS-232 standard.

The IEEE 488 and the serial interfaces are always enabled, and can be used alternatively. The DLS 90 directs its output to the last interface it received data from. Both interfaces use the same command set and produce the same results.

Section 3.1 and 3.2 describe the functions specific to one particular interface, the remainder of section 3 describes the commands that are common to both interfaces.

3.1 IEEE 488 Interface

3.1.1 IEEE 488.1 Interface functions supported

The IEEE 488.1 Interface functions supported by the DLS 90 are as follows :

SH1	Source handshake - full capability
AH1	Acceptor handshake - full capability
T5	Basic talker - serial poll, untalk on MLA
L3	Basic listener - unlisten on MTA
SR1	Service request - full
DC1	Device clear - full
C4	Respond to SRQ
E1	Open Collector drivers
RL1	Remote Local - full

These represent the minimum required to implement the IEEE 488.2 standard.

For example, to get the identification message with the IEEE 488 interface, do the following:

- 1. transmit "*SRE 48" → enable MAV and ESB (needed only once)
- 2. transmit "*ESE 60" → enable all the error flags (needed only once)

- 3. transmit "*IDN?" → query the identification message
- 4. wait for SRQ to be raised
- 5. read the status byte → use the IEEE 488.1 command, not *STB?
- 6. if MAV is set read the response

- 7. if ESB is set do the following → check if an error was detected
- 8. transmit "*ESR?" → query the Event Status Register
- 9. wait for SRQ to be raised
- 10.if MAV is set read the response and take all the relevant action according to the error type received

If desired, all the enable registers can be restored on power up with the *PSC command.

3.1.4 Message Terminators

Messages to the DLS 90 must be terminated with either a Line Feed character (ASCII <LF>, decimal 10, hex 0A), an IEEE 488.1 EOI signal or both. Messages from the DLS 90 are always terminated with a Line Feed character and the IEEE 488.1 EOI signal.

3.2 RS-232 Serial Interface

The DLS 90 uses a female DB-25 connector, and is configured as a DCE device.

To use the serial interface, simply connect your computer to the DLS 90 and set both the computer and DLS 90 to the same protocol: baud rate, data format and flow control. Do NOT use a null modem. The following sections give more details on the various protocols.

The RS-232 serial interface can be set from the front panel (see section 2.4) or remotely (see sections 3.7.3 to 3.7.5) with either the serial or the IEEE 488 interfaces.

3.2.1 Baud Rate

The DLS 90 supports the following baud rates:

300, 600, 1200, 2400, 4800, 9600, 19 200 and 38 400 bits per second.

The default is 9600 bps.

This protocols controls the data flow in both directions. Note that the RTS line is not the usual "Request To Send" as defined by the RS-232 standard.

3.2.3.4 XOn/XOff Flow Control

When XOn/XOff flow control is selected, the DLS 90 stops transmitting data when it receives the XOff character (decimal 19, hex 13, ^S), and restarts when it receives the XOn character (decimal 17, hex 11, ASCII ^Q). The DLS 90 will send XOff when it cannot accept data and will send XOn when it can.

This protocol controls the data flow in both directions.

3.2.3.5 "All" Flow Control

When "All" flow control is selected, the DLS 90 uses both the RTS/CTS and the XOn/XOff flow control.

This protocol controls the data flow in both directions.

3.2.4 Message Terminators

Any message sent to the DLS 90 through the serial interface MUST be terminated with the line feed character (decimal 10, hex 0A, LF). To ensure that no characters were left in the receive buffer of the DLS 90 from an old, incomplete command, you can send the line feed character by itself before sending new commands. Messages from the DLS 90 are always terminated with a Line Feed character.

3.3 Data formats

The DLS 90 adheres to the IEEE 488.2 principle of Forgiving Listening and Precise Talking.

The DLS 90 can accept data in the <NRf> format, which means that numbers can be made of a combination of digits, signs, decimal point, exponent, multiplier, unit and spaces. For example, any of the following are valid representation for 9000 feet: 9kft, 9.0 kft, 9000, 9E3 ft, +9000. If a unit is appended to a number, it must be valid in the current context. Note that the period separates the decimal part of a number.

Queries of the system follow the same format as the commands, except that the data normally associated with a command is replaced by a question mark "?". Following receipt of such a command, the DLS 90 will place the appropriate response on the output queue, where it can be read by the controller.

Examples are:

***IDN?**
***ESE?;*SRE?**
:SET:CHAN:LEN?

When a command does not begin with a colon, the DLS 90 assumes that the command is at the same level as the previous command. For example, to set the serial interface, one does need to specify ':SYStem:COMMunicate:SERial' each time, such as in:

:SYStem:COMMunicate:SERial:BAUD 9600;PACE CTS
FORMAT N81

This shorter form is valid because BAUD, PACE and FORMAT are at the same level.

3.5.2 Event Status Register (ESR)

The Event Status Register monitors events within the system and reports on those enabled. It records transitory events as well. The DLS 90 implements only the IEEE 488.2 Standard Event Status Register (ESR). It is defined as:

bit 0 Operation Complete. This bit is set in response to the *OPC command when the current operation is complete.

bit 1 Request Control. The DLS 90 does not have the ability to control the IEEE bus, and so this bit is always 0.

bit 2 Query Error. There was an attempt to read an empty output queue or there was an output queue overflow. (maximum output queue capacity is 50 bytes).

bit 3 Device Dependent Error. At this time there are no device dependent errors in the DLS 90, so this bit is always 0.

bit 4 Execution Error. The data associated with a command was out of range.

bit 5 Command Error. Either a syntax error (order of command words) or a semantic error (spelling of command words) has occurred. A GET (Group Execute Trigger) or *TRG command will also set this bit.

bit 6 User Request. Indicates that the user has activated a Device Defined control through the front panel. Not used, so this bit is always 0.

bit 7 Power on. This bit is set when the DLS 90 is turned on. Sending *ESR? clears the bit and stays cleared until the power is turned on again.

The setting of the Event Status Register can be read with the Event Status Register query command (*ESR?). This will put the value of the register in the output queue, **AND** will clear the register.

3.6 Common Command Set

As specified in the IEEE 488.2 standard, a number of common commands are required to set up and control of standard functions of remote controlled devices. These common commands are as follow:

***CLS** **Clear Status Command**

Type: Status command
Function: Clears the Event Status Register (ESR). Clearing the Event Status Register will also clear ESB, the bit 5 of the Status Byte Register (STB). It has no effect on the output queue (bit 4 of the STB).

***ESE <NRf> Event Status Enable**

***IDN?** **Identification Query**

Type: System command
Function: Returns the ID of the unit. Upon receiving this command the DLS 90 will put into the output queue the following string:

CONSULTRONICS LTD,DLS 90 <Gauge>-<MaxLen Unit>,<SN>,<Ver>

where:

<Gauge>	is the gauge installed in the unit
<MaxLen Unit>	is the maximum length supported by the DLS 90, followed by the unit of the length
<SN>	is the serial number of the unit
<Ver>	is the revision level of the control firmware (always 2 digits)

***OPC** **Operation Complete**

Type: Synchronization command
Function: Indicates to the controller when the current operation is complete. This command will cause the DLS 90 to set bit 0 in the Event Status Register (ESR) when all pending operations are completed. The bit is read with the *ESR? command, which also clear the bit. Communication can proceed as normal after this command, but be prepared to receive SRQ at any time. See section "DLS 90 Synchronization" for more details.

***OPC?** **Operation Complete Query**

Type: Synchronization command
Function: Indicates when the current operation is complete. This will cause the DLS 90 to put an ASCII 1 (decimal 49, hex 31) in the output queue when the current operation is complete. Communication can proceed as normal after this command, but be prepared to receive the "1" at any time. See the section 3.8 for more details.

***PSC <NRf> Power-on Status Clear**

Type: Status and event command
Function: Indicates if the unit should clear the Service Request Enable Register and the Standard Event Status Register at power-on. If 1 then all the enable registers are cleared at power-on, if 0 then all the enable registers are restored from the non-volatile RAM at power-on. The factory default is 1 (clear all the enable registers). Any change to the "Power-on Status" is saved in non-volatile RAM, and is always restored on power up.

***STB?** **Status Byte Query**

Type: Status command
Function: The value of the Status Byte Register is put into the output queue. Contrary to the "*ESR?" command, this register is not cleared by reading it. The register will be zero only when all its related structures are cleared, namely the Event Status Register (ESR) and/or the output queue.

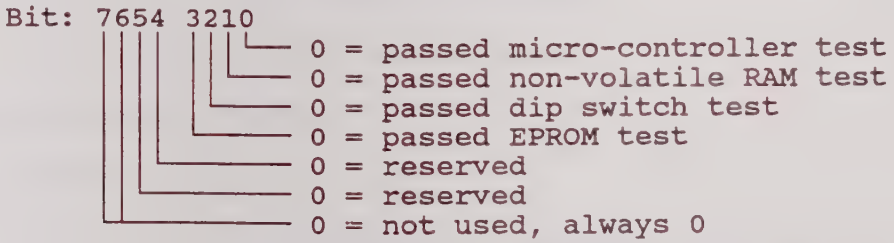
Note that bit 6 is MSS, which does not necessarily have the same value as RQS (see section 3.5.1 for more details).

***TRG** **Trigger**

Type: Trigger command
Function: Trigger operation of the device. Since the DLS 90 has no functions that can be triggered this command has no effect on the operation of the unit.

***TST?** **Self-Test Query**

Type: Internal command
Function: Returns the results of the self-test done at power up. The number returned has the following bit map:


Bit: 7654 3210
0 = passed micro-controller test
0 = passed non-volatile RAM test
0 = passed dip switch test
0 = passed EPROM test
0 = reserved
0 = reserved
0 = not used, always 0

Bit 7 to 0 have a respective value of 128, 64, 32, 16, 8, 4, 2 and 1. For example if bit 3 and 5 are set then the integer value is 40 (8+32).

***WAI** **Wait to continue**

Type: Synchronization command
Function: Used to delay execution of commands. The DLS 90 will ensure that all commands received before "*WAI" are completed before processing any new commands. This means that all further communication with the DLS 90 will be frozen until all pending operations are completed. See section "DLS 90 Synchronization" for more details.

3.7.2 :SYStem:COMMunicate:GPIB:ADDRess <NRf>

Set the address of the IEEE 488.1 interface, where <NRf> is the address ranging from 0 to 30. For example, to set the address to 13, send:

:SYS:COMM:GPIB:ADDR 13

Note that the new address must be used immediately for any further IEEE 488 communication.

To query the current address send:

:SYS:COMM:GPIB:ADDR?

The command will return an integer number ranging from 0 to 30. For example, if the address is 13, the return message will be:

13

3.7.3 :SYStem:COMMunicate:SERial:BAUD <NRf>

Set the receiver and transmitter baud rate of the serial interface, where <NRf> is any of the following choices:

300 ¦ 600 ¦ 1200 ¦ 2400 ¦ 4800 ¦ 9600 ¦ 19200 ¦ 38400

For example, to set the baud rate to 9600 bit per second, send:

:SYS:COMM:SER:BAUD 9600 bps

The units are optional, but they must be "bps" if used.

Note that the new baud rate must be used immediately for any further serial communication.

To query the current baud rate send:

:SYS:COMM:SER:BAUD?

The command will return the baud rate as an integer number. For example, if the baud rate is 9600 bps, the return message will be:

9600

To query the current pacing method send:

:SYS:COMM:SER:PACE?

The command will return the pacing method as a string. For example, if the pacing method is RTS/CTS, the returned message will be:

RTS/CTS

To simplify the setting of the serial interface, we used a slightly modified SCPI command set. The SCPI standard requires separate settings for the RTS/CTS flow control and XOn/XOff pacing, and differentiates between the receive and the transmit sides. The command set of the DLS 90 combines the ":RTS" and the "XON" settings into one ":PACE" command.

Note that the SCPI standard assumes a DTE configuration, whereas the DLS 90 is configured as a DCE port (thus not requiring a Null Modem).

3.8 DLS 90 Synchronization

The program controlling the DLS 90 can use three different commands to synchronize with the DLS 90: *OPC, *OPC? and *WAI. Following are the main differences:

	Set Operation Complete bit when Done	Return "1" when operation complete	Raise SRQ when operation complete	Block comm. with the DLS 90	Required Enable Bit(s)
*OPC	Yes	No	Yes (1)	No	Operation Complete, ESB
*OPC?	No	Yes	Yes (2)	No	MAV
*WAI	No	No	No	Yes	none

(1) if "Operation Complete" and ESB are enabled
(2) if MAV is enabled

The main difference between OPC and WAI is that WAI will block any further communication with the DLS 90 until all pending operations are completed. The main difference between *OPC and *OPC? is that *OPC set the "Operation Complete" bit, and *OPC? will return an ASCII "1" when all pending operations are completed. Make sure that all the required enable bits are set.

When using *OPC or *OPC?, the program controlling the DLS 90 can determine when the operation is completed by waiting for SRQ, or by reading the status byte with the serial poll or with *STB? (if corresponding bits are enabled).

If the program uses the *OPC? command and then sends more queries, the program must be ready to receive the "1" concatenated to other responses at any time.

When using *WAI, the communication time out should be set long enough to avoid losing data (the DLS 90 needs approximately 200 ms to set a length).

Section 4 WARRANTY

Consultronics warrants all equipment bearing its nameplate to be free from defects in workmanship and materials, during normal use and service, for a period of twelve (12) months from the date of shipment. In the event that a defect in any such equipment arises within the warranty period it shall be the responsibility of the customer to return the equipment by prepaid transportation to a Consultronics service centre prior to the expiration of the warranty period for the purpose of allowing Consultronics to inspect and repair the equipment. If inspection by Consultronics discloses a defect in workmanship or material it shall, at its option, repair or replace the equipment without cost to the customer, and return it to the customer by the least expensive mode of transportation, the cost of which shall be prepaid by Consultronics. In no event shall this warranty apply to equipment which has been modified without the written authorization of Consultronics, or which has been subjected to abuse, neglect, accident or improper application. If inspection by Consultronics discloses that the repairs required to be made on the equipment are not covered by this warranty, the regular repair charges shall apply to any repairs made to the equipment.

This warranty constitutes the only warranty applicable to the equipment sold by Consultronics and no other warranty or condition, statutory or otherwise, express or implied shall be imposed upon Consultronics nor shall any representation made by any person including a representation by a representative or agent of Consultronics be effective to extend the warranty coverage provided herein. In no event (including, but not limited to the negligence of Consultronics, its agents or employees) shall Consultronics be liable for special consequential damages or damages arising from the loss of use of the equipment and on the expiration of the warranty period all liability of Consultronics whatsoever in connection with the equipment shall terminate.

If warranty service becomes necessary, please phone or fax Consultronics to get return authorization number and shipping instructions :

Consultronics Ltd. (Head Office)
160 Drumlin Circle
Concord, Ontario, Canada
L4K 3E5
Phone : (905) 738-3741 or
In N.America Only: 1-800-267-7235
Fax : (905) 738-3712

Consultronics Ltd. (Ottawa Office)
169 Colonnade Rd.,
Nepean, Ontario, Canada
K2E 7J4
Phone : (613) 225-6087 or
In N.America Only: 1-800-465-1796
Fax : (613) 225-6315

Consultronics (U.S.A. Office)
5258 Ashley Drive
Lilburn, GA
30247
Phone: (404) 921-3449 or
In N. America Only: 1-800-267-7235
Fax:(404) 381-5810

Consultronics (Europe Office)
Unit A
Omega Enterprise Park
Electron Way
Chandlers Ford
Hampshire, England
SO5 3SE
Phone : 0703 270222
Fax : 0703 270333

or your local Consultronics representative

Section 6 SPECIFICATIONS

The DLS 90 is a two wire cable simulator. The user can select the simulated cable length using the keys on the front panel, or via one of the remote control interfaces (i.e IEEE488 or RS-232). For AWG gauges, the length can be varied from 0 to 6.35 kft in steps of 50 ft. With the extended wireline option, a maximum length of 9.35 kft can be achieved. The DLS 90 (0.4mm PE version) simulates up to 3 km of cable and the maximum length can be varied in steps of 50m.

Simulated Cable Type and Maximum Length:

The DLS-90 simulates one gauge of cable which may be 26, 24 AWG or 0.4mm PE.
The gauge must be specified at the time of order.
The maximum length can be up to 9.35 kft for AWG units, and in 3.0 km for 0.4mm PE.

Frequency Response:

From DC to 1.5 MHz.
Accuracy:

±0.5 dB up to 20 dB attenuation,
±1 dB from 21 dB up to 35 dB attenuation,
±2 dB up to 70 dB attenuation.

Delay:
From 20 KHz to 1 MHz, ±10%

Characteristic Impedance:
From 20 KHz to 999 KHz, ±5%
From 1 MHz to 1.5 MHz, ±10%

DC Characteristics:
DC Resistance ± 5%
100 mA, 300 V maximum DC + peak AC between tip & ring

IEEE 488 Remote Control:
The unit can be controlled via an IEEE 488 interface. The unit supports the following functions:

a) Listener
b) Talker
c) Local Lockout
d) Serial Poll
e) Selective Device Reset
f) Bus Reset
g) Primary Addressing from 0 to 30

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Fax: (613) 225-6315

EQUIPMENT REGISTRATION FORM

IMPORTANT! For us to keep you up to date on all upgrades and revisions for your equipment, please complete and return the registration form.

COMPANY: .....

DIVISION: .....

ADDRESS: .....

.....

.....

.....

.....

ATTENTION: .....

TELEPHONE: .....

FAX NUMBER: .....

EQUIPMENT MODEL: .....

SERIAL NUMBER: .....

OPTIONS: .....

.....

SOFTWARE VERSION: .....

COMMENTS: .....

.....

.....

.....

.....

.....

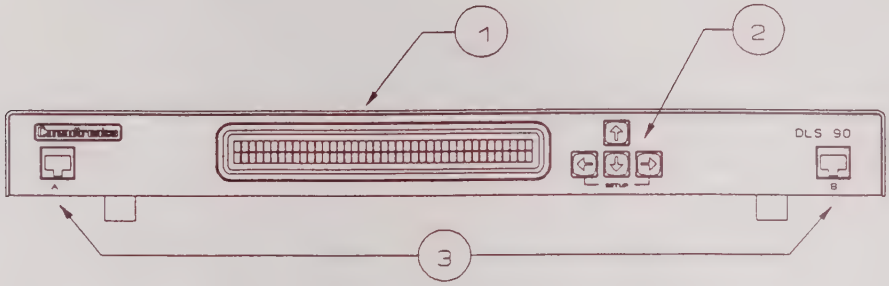


Fig. 1.1 The DLS 90's Front Panel

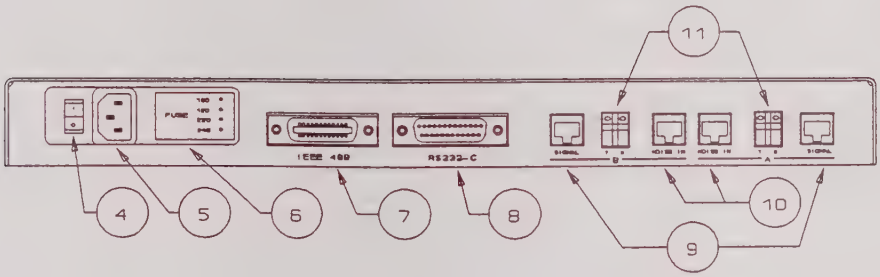


Fig. 1.2 The DLS 90's Back Panel

1. Liquid crystal display (LCD).
2. Menu control / setup keys.
3. RJ-45 modular connector for device under test, one on each end of the wireline (internally connected to items 9, 10 and 11).
4. Power switch
5. AC power input plug
6. Power voltage selector and fuse case
7. IEEE 488 interface connector for remote control
8. RS-232 serial interface connector for remote control
9. Modular connector for device under test (internally connected to items 3, 10 and 11)
10. Modular connector for injection of impairments (internally connected to items 3, 9 and 11)
11. Terminal strip for connection to device under test (internally connected to items 3, 9 and 10).

LOSS TABLES
26 Gauge DLS 90 Unit

Dist	1Kft	2kft	3kft
kHz			
10	-2.85 < A <-1.85	-4.73 < A <-3.73	-6.36 < A <-5.36
40	-2.97 < A <-1.97	-5.38 < A <-4.38	-8.02 < A <-7.02
100	-3.52 < A <-2.52	-7.03 < A <-6.03	-10.37 < A <-9.37
300	-5.00 < A <-4.00	-9.48 < A <-8.48	-13.95 < A <-12.95
700	-7.13 < A <-6.13	-13.70 < A <-12.70	-20.22 < A <-19.22
1000	-8.43 < A <-7.43	-16.26 < A <-15.26	-24.57 < A <-22.57
1200	-9.18 < A <-8.18	-17.68 < A <-16.68	-26.67 < A <-24.67
1500	-10.26 < A <-9.26	-19.81 < A <-18.81	-29.87 < A <-27.87

Dist	4Kft	5kft	6kft
kHz			
10	-7.87 < A <-6.87	-9.35 < A <-8.35	-10.84 < A <-9.84
40	-10.79 < A <-9.79	-13.57 < A <-12.57	-16.32 < A <-15.32
100	-13.70 < A <-12.70	-17.08 < A <-16.08	-20.43 < A <-19.43
300	-18.42 < A <-17.42	-23.39 < A <-21.39	-27.86 < A <-25.86
700	-27.52 < A <-25.52	-33.78 < A <-31.78	-41.31 < A <-37.31
1000	-32.37 < A <-30.37	-41.17 < A <-37.17	-48.97 < A <-44.97
1200	-35.17 < A <-33.17	-44.68 < A <-40.68	-53.18 < A <-49.18
1500	-40.44 < A <-36.44	-50.00 < A <-46.00	-59.56 < A <-55.56

If there is a problem with verifying the calibration of the unit, contact Consultronics Service Department at the numbers / address provided below.

Please have the following information available so we can give you the fastest possible assistance:

Unit type and serial number.

CALL: 1-800-465-1796 (Canada & U.S.)
(613) 225-6087
FAX: (613) 225-6315

OR WRITE TO: CUSTOMER SERVICE
Consultronics Limited
169 Colonnade Road
Nepean, Ontario
Canada
K2E 7J4

SERVICE DEPARTMENT

DLS 90

Service Manual

Version 1.02
January 26, 1995

Consultronics

DLS 90 CALIBRATION VERIFICATION PROCEDURE

DLS 90 Calibration Verification

The following calibration verification procedure applies only to the DLS 90 attenuations and is used only to verify the calibration of the unit. Units passing this procedure will have the response of a new unit.

Changing the response of the unit can only be done at our factory because of the complex procedures involved.

This procedure is not intended to expose isolated settings that may be faulty. If this is the requirement then the unit must be returned to the factory where the special equipment needed to do that testing is available.

This procedure may be used for periodic calibration. The calibration period is usually set by the metrology department of a company and in most cases is one year.

Note: **This procedure assumes that you are familiar with the operation of the DLS 90 (for details regarding the operation of the DLS, refer to the Operating and Reference Manual).**

This procedure should be read in its entirety before beginning any of the verifications.

1) **Equipment Required** W&G SPM-15 Selective Level Meter (or equivalent) with balanced 135Ω output. Frequency to 2 MHz. Output level to 0 dBm. Balanced 135 ohm input capable of measuring to 2 MHz.

2) **Procedure**

Connect the output from the SPM-15 to the front phone jack on side A. Connect the input of the SPM-15 to the back phone jack on side B. Set the SPM-15 input and output to 135Ω and the bandwidth to 3.1KHz. Take readings at lengths and frequencies shown below and compare to the values in the tables below.

LOSS TABLES
26 Gauge DLS 90 Unit

Dist	1Kft	2kft	3kft
kHz			
10	-2.85 < A <-1.85	-4.73 < A <-3.73	-6.36 < A <-5.36
40	-2.97 < A <-1.97	-5.38 < A <-4.38	-8.02 < A <-7.02
100	-3.52 < A <-2.52	-7.03 < A <-6.03	-10.37 < A <-9.37
300	-5.00 < A <-4.00	-9.48 < A <-8.48	-13.95 < A <-12.95
700	-7.13 < A <-6.13	-13.70 < A <-12.70	-20.22 < A <-19.22
1000	-8.43 < A <-7.43	-16.26 < A <-15.26	-24.57 < A <-22.57
1200	-9.18 < A <-8.18	-17.68 < A <-16.68	-26.67 < A <-24.67
1500	-10.26 < A <-9.26	-19.81 < A <-18.81	-29.87 < A <-27.87

Dist	4Kft	5kft	6kft
kHz			
10	-7.87 < A <-6.87	-9.35 < A <-8.35	-10.84 < A <-9.84
40	-10.79 < A <-9.79	-13.57 < A <-12.57	-16.32 < A <-15.32
100	-13.70 < A <-12.70	-17.08 < A <-16.08	-20.43 < A <-19.43
300	-18.42 < A <-17.42	-23.39 < A <-21.39	-27.86 < A <-25.86
700	-27.52 < A <-25.52	-33.78 < A <-31.78	-41.31 < A <-37.31
1000	-32.37 < A <-30.37	-41.17 < A <-37.17	-48.97 < A <-44.97
1200	-35.17 < A <-33.17	-44.68 < A <-40.68	-53.18 < A <-49.18
1500	-40.44 < A <-36.44	-50.00 < A <-46.00	-59.56 < A <-55.56

Dist	6.35Kft	7kft	8kft
kHz			
10	-11.37 < A <-10.37	-12.37 < A <-11.37	-13.95 < A <-12.95
40	-17.38 < A <-16.38	-19.04 < A <-18.04	-22.27 < A <-20.27
100	-22.11 < A <-20.11	-24.28 < A <-22.28	-27.64 < A <-25.64
300	-29.43 < A <-27.43	-32.33 < A <-30.33	-36.80 < A <-34.80
700	-43.60 < A <-39.60	-47.84 < A <-43.84	-54.37 < A <-50.37
1000	-51.71 < A <-47.71	-56.78 < A <-52.78	-64.58 < A <-60.58
1200	-56.16 < A <-52.16	-61.68 < A <-57.68	-70.18 < A <-66.18
1500	-62.91 < A <-58.91	-69.13 < A <-65.13	*

Dist	9Kft	9.35Kft
kHz		
10	-15.57 < A <-14.57	-16.14 < A <-15.14
40	-25.00 < A <-23.00	-25.96 < A <-23.96
100	-31.00 < A <-29.00	-32.18 < A <-30.18
300	-42.26 < A <-38.26	-43.86 < A <-39.86
700	-60.90 < A <-56.90	-63.18 < A <-59.18
1000	-72.38 < A <-68.38	*
1200	*	*
1500	*	*

LOSS TABLES
24 Gauge DLS 90 Unit

Dist	1Kft	2kft	3kft
kHz			
10	-2.25 < A <-1.25	-3.59 < A <-2.59	-4.80 < A <-3.80
40	-2.36 < A <-1.36	-4.07 < A <-3.07	-5.95 < A <-4.95
100	-2.85 < A <-1.85	-5.33 < A <-4.33	-7.59 < A <-6.59
300	-4.16 < A <-3.16	-7.59 < A <-6.59	-11.00 < A <-10.00
700	-5.99 < A <-4.99	-11.21 < A <-10.21	-16.37 < A <-15.37
1000	-7.02 < A <-6.02	-13.24 < A <-12.24	-19.43 < A <-18.43
1200	-7.66 < A <-6.66	-14.38 < A <-13.38	-21.71 < A <-19.71
1500	-8.52 < A <-7.52	-16.07 < A <-15.07	-24.25 < A <-22.25

Dist	4Kft	5kft	6kft
kHz			
10	-5.94 < A <-4.94	-7.05 < A <-6.05	-8.16 < A <-7.16
40	-7.93 < A <-6.93	-9.91 < A <-8.91	-11.85 < A <-10.85
100	-9.89 < A <-8.89	-12.24 < A <-11.24	-14.54 < A <-13.54
300	-14.41 < A <-13.41	-17.82 < A <-16.82	-21.82 < A <-19.82
700	-22.13 < A <-20.13	-27.30 < A <-25.30	-32.47 < A <-30.47
1000	-26.21 < A <-24.21	-32.39 < A <-30.39	-38.57 < A <-36.57
1200	-28.44 < A <-26.44	-35.18 < A <-33.18	-42.92 < A <-38.92
1500	-31.83 < A <-29.83	-39.41 < A <-37.41	-47.99 < A <-43.99

Dist	6.35Kft	7kft	8kft
kHz			
10	-8.56 < A <-7.56	-9.30 < A <-8.30	-10.47 < A <-9.47
40	-12.53 < A <-11.53	-13.77 < A <-12.77	-15.67 < A <-14.67
100	-15.35 < A <-14.35	-16.86 < A <-15.86	-19.18 < A <-18.18
300	-22.92 < A <-20.92	-25.63 < A <-23.63	-28.63 < A <-26.63
700	-34.28 < A <-32.28	-37.63 < A <-35.63	-43.80 < A <-39.80
1000	-40.74 < A <-38.74	-45.76 < A <-41.76	-51.94 < A <-47.94
1200	-45.28 < A <-41.28	-49.66 < A <-45.66	-56.39 < A <-52.39
1500	-50.65 < A <-46.65	-55.57 < A <-51.57	-63.15 < A <-59.15

Dist	9Kft	9.35Kft
kHz		
10	-11.68 < A <-10.68	-12.11 < A <-11.11
40	-17.59 < A <-16.59	-18.27 < A <-17.27
100	-22.09 < A <-20.09	-22.91 < A <-20.91
300	-32.04 < A <-30.04	-33.23 < A <-31.23
700	-48.97 < A <-44.97	-50.78 < A <-46.78
1000	-58.12 < A <-54.12	-60.29 < A <-56.29
1200	-63.13 < A <-59.13	-65.50 < A <-61.50
1500	-70.74 < A <-66.74	*

NOTE: Ensure that the level read at distances marked '*' is lower than the reading at the previous frequency.

If there is a problem with verifying the calibration of the unit, contact Consultronics Service Department at the numbers / address provided below.

Please have the following information available so we can give you the fastest possible assistance:

Unit type and serial number.

CALL: 1-800-465-1796 (Canada & U.S.)
(613) 225-6087
FAX: (613) 225-6315

OR WRITE TO: CUSTOMER SERVICE
Consultronics Limited
169 Colonnade Road
Nepean, Ontario
Canada
K2E 7J4

SERVICE DEPARTMENT

DLS 90

Calibration Verification Procedure

Version 1.02
January 26, 1995

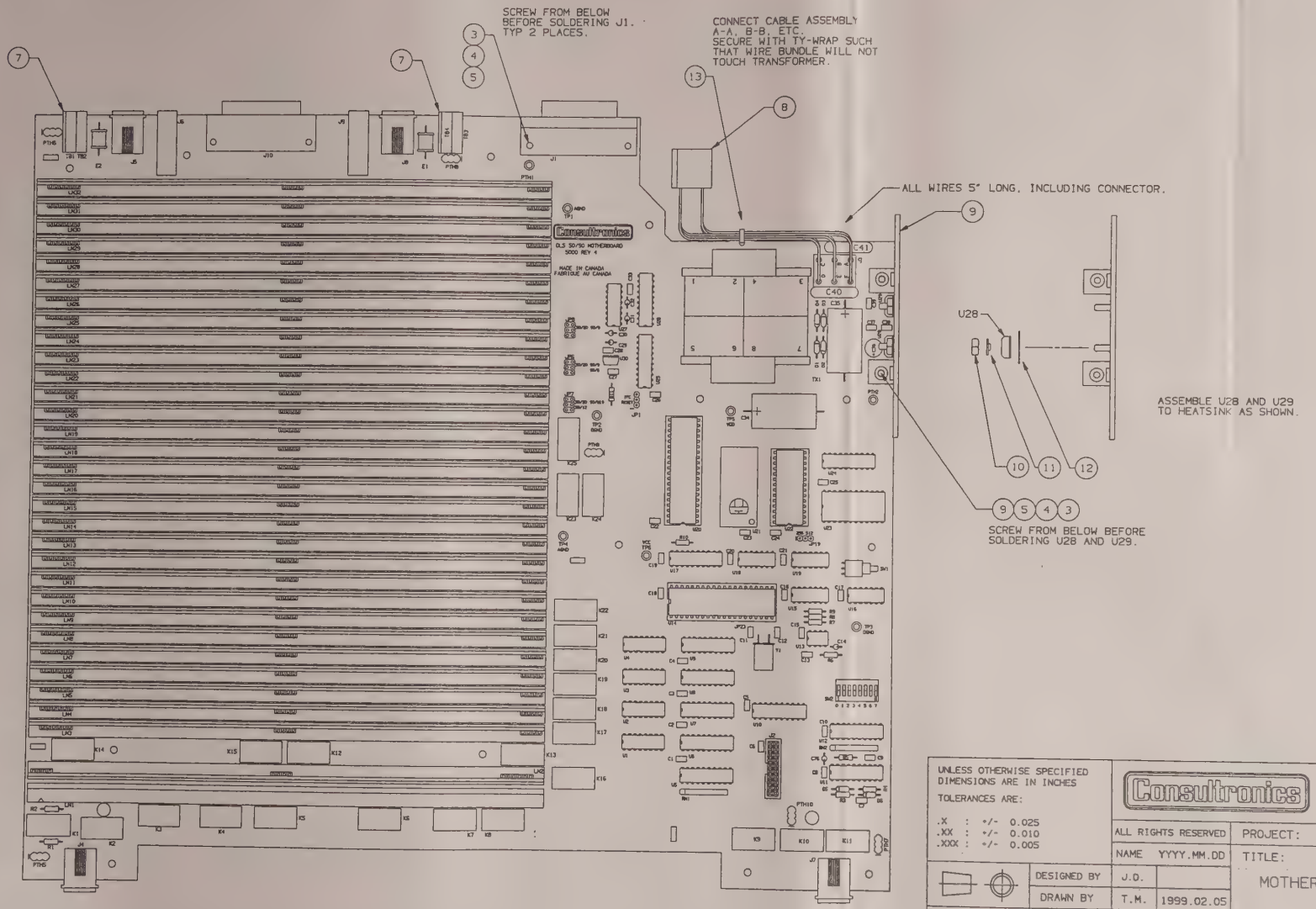
Consultronics

SERVICE DEPARTMENT

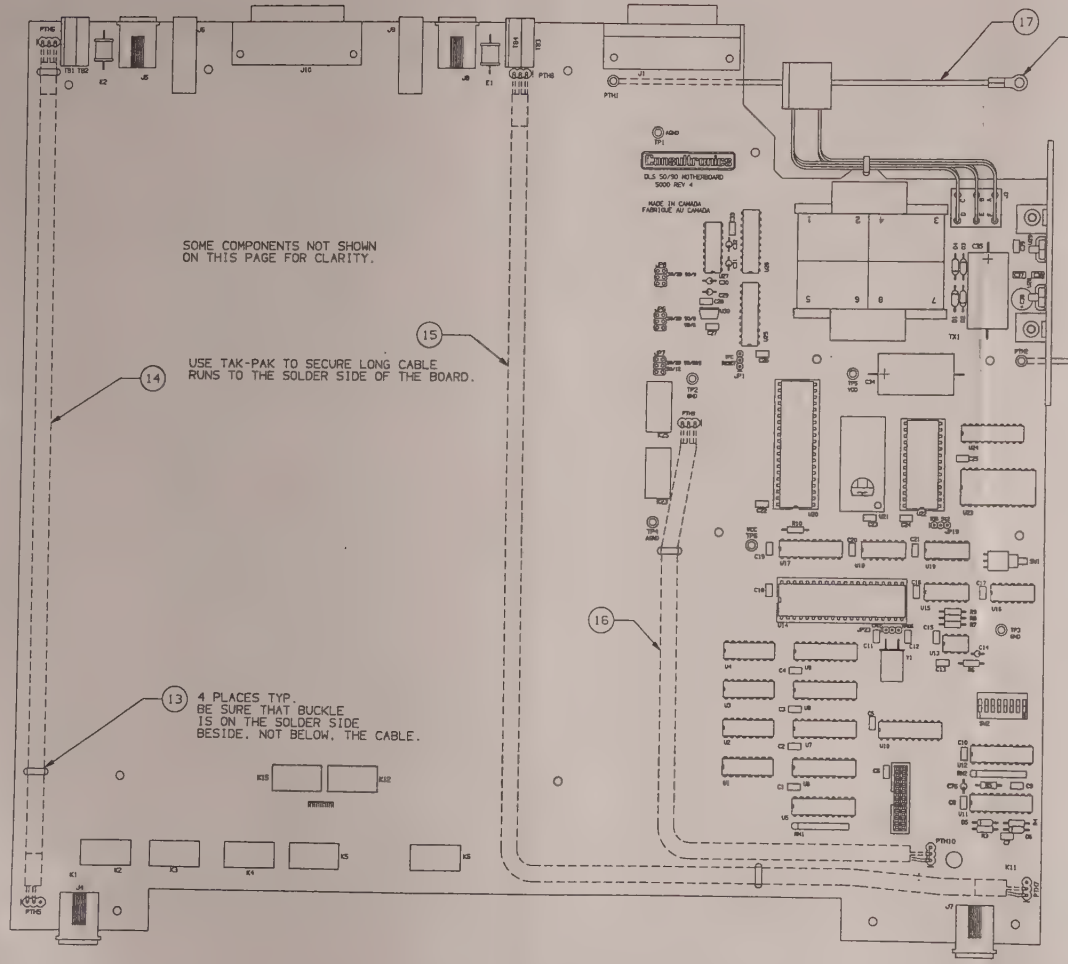
DLS 90

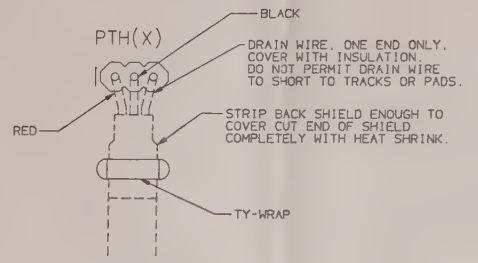
Assembly Drawing

Consultronics


SCREW FROM BELOW BEFORE SOLDERING J1. TYP 2 PLACES.
CONNECT CABLE ASSEMBLY A-A, B-B, ETC. SECURE WITH TY-WRAP SUCH THAT WIRE BUNDLE WILL NOT TOUCH TRANSFORMER.
ALL WIRES 5" LONG, INCLUDING CONNECTOR.
U28
ASSEMBLE U28 AND U29 TO HEATSINK AS SHOWN.
SCREW FROM BELOW BEFORE SOLDERING U28 AND U29.
Consultronics
DLS 50/90 MOTHERBOARD
5000 REV 4
MADE IN CANADA
FABRIQUE AU CANADA

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: .X : +/- 0.025 .XX : +/- 0.010 .XXX : +/- 0.005	Consultronics	169 COLONNADE ROAD NEPEAN, ONTARIO, CANADA K2E 7J4 (613)225-6087	
	ALL RIGHTS RESERVED	NAME YYYY.MM.DD	PROJECT: DLS 50 / 90
	DESIGNED BY	J.D.	TITLE: MOTHERBOARD, DLS 50/90
	DRAWN BY	T.M. 1999.02.05	
PROTOTYPE ☐ PRODUCTION ■	ECN #	3447	DRAWING NO: 5000-C REV: 4.02
	INVENTORY #	7102010156	SCALE: NTS SHT 1 OF 2


SOME COMPONENTS NOT SHOWN ON THIS PAGE FOR CLARITY.
USE TAK-PAK TO SECURE LONG CABLE RUNS TO THE SOLDER SIDE OF THE BOARD.
4 PLACES TYP. BE SURE THAT BUCKLE IS ON THE SOLDER SIDE BESIDE, NOT BELOW, THE CABLE.
13
14
15
16
17
18
Consultronics
DLS 50/90 MOTHERBOARD
5000 REV 4
MADE IN CANADA
FABRIQUÉ AU CANADA

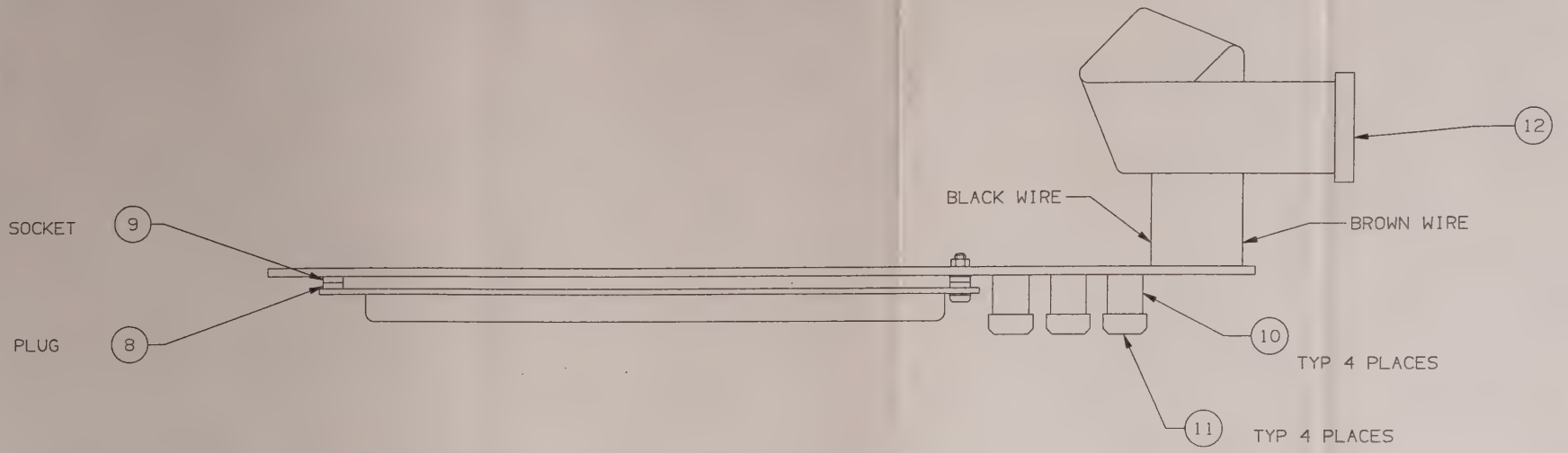

PTH(X)
BLACK
DRAIN WIRE, ONE END ONLY. COVER WITH INSULATION. DO NOT PERMIT DRAIN WIRE TO SHORT TO TRACKS OR PADS.
RED
STRIP BACK SHIELD ENOUGH TO COVER CUT END OF SHIELD COMPLETELY WITH HEAT SHRINK.
TY-WRAP

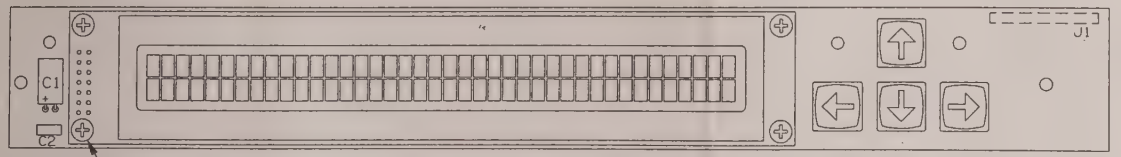
DETAIL A

NOTES:
1. ITEM 14 IS TO BE 13.75" LONG.
2. ITEM 15 IS TO BE 21.00" LONG.
3. ITEM 16 IS TO BE 11.50" LONG.
4. TRIM SOLDER TAILS VERY SHORT ON THESE COMPONENTS: K7, K8, K9, K10, K11, K16, K17, K18, K19, K20, K21, K22, K24.
5. ITEMS 14, 15, AND 16 ARE TO HAVE HEAT SHRINK COVERING THE CUT ENDS OF THE OUTER INSULATION. THE STRIPPED ENDS ARE TO BE TINNED BEFORE INSTALLATION. THE GROUND WIRES ARE TO BE INSULATED, AND CONNECTED AT ONE END ONLY (AT PTH 6, PTH 8, AND PTH 9).
6. THE RED WIRES OF THE ABOVE CABLES ARE TO BE SOLDERED AT PIN 1 AND THE BLACK WIRE AT PIN 2 AS SHOWN IN DETAIL A.
7. THE ABOVE CABLES ARE TO BE TIED TO THE SOLDER SIDE USING TAK-PAK AND TY-WRAPS (REF 13) SUCH THAT THE BUCKLES ARE BESIDE THE CABLE. SO THAT THEY DO NOT INCREASE THE THICKNESS OF THE ASSEMBLY.
8. GROUND WIRES (REF 17, REF 18) ARE TO BE INSTALLED AT PTH1 AND PTH2, AS SHOWN. BOTH ARE TO BE 7" LONG.

Consultronics
169 COLONNADE ROAD,
NEPEAN, ONTARIO, CANADA
K2E 7J4
(613) 225-6087

PROJECT	:	DLS 50 / DLS 90	
TITLE	:	MOTHERBOARD, DL5 / DL9	
DRAWING NO:		5000-C	REV: 4.02
SCALE	:	NTS	SHT 2 OF 2





1. SCREW
2. FIBRE WASHER
3. LCD
4. PLASTIC WASHER
4. PLASTIC WASHER
2. FIBRE WASHER
6. PCB
2. FIBRE WASHER
7. LOCKNUT

TYP 4 PLACES

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

TOLERANCES ARE:

.X : +/- 0.025
.XX : +/- 0.010
.XXX : +/- 0.005

DESIGNED BY: J.N.E.
DRAWN BY: T.M. 1996.11.27

PROTOTYPE ☐
PRODUCTION ■

ECN # 2390
INVENTORY # B5001ZZZ07

Consultronics
169 COLONNADE ROAD
NEPEAN, ONTARIO, CANADA
K2E 7J4
(613)225-6087

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NAME YYYY.MM.DD

PROJECT: DLS 50 / 90

TITLE: DISPLAY ASSEMBLY

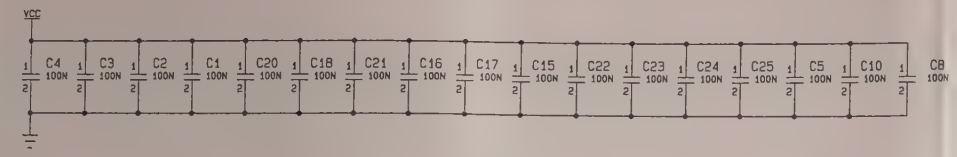
DRAWING NO: 5001-C REV: 1.00

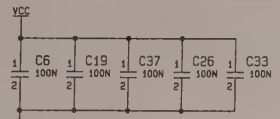
SCALE: NTS SHT 1 OF 1

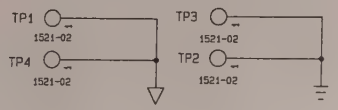
DLS 90

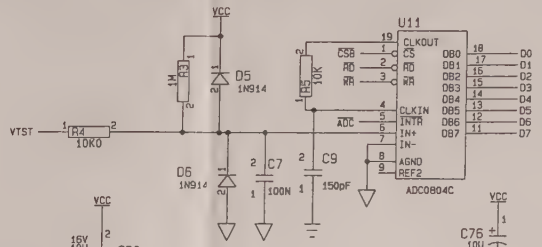
Schematics

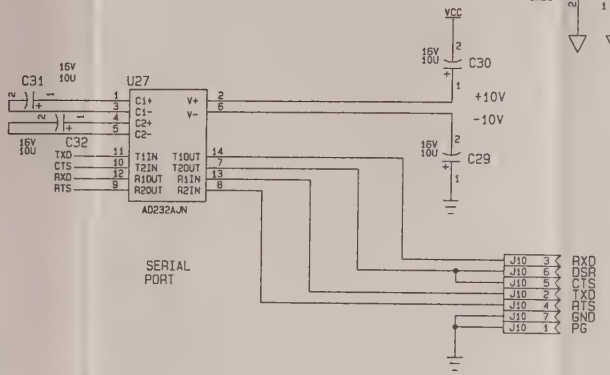
Consultronics

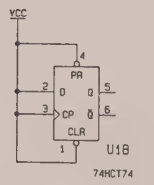


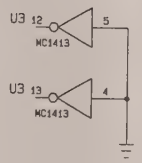












U11	ADC0804	20	20					10
U17	DS1667-10	20	20	3				10
U27	AD232AJN	16	16					15
U10	HCT245	20	20					10
U22	27C256	28	28					14
U16, U19	74HC14	14	14					7
U15	74HC00	14	14					7
U13	TTL7705B	8	8					4
U18	74HCT74	14	14					7
U20	7210APD	40	40					20
U26	DS75161A	20	20					10
U25	DS75160	20	20					10
U14	80C32BH	40	40					20
U5, 6, 7, 8, 9, 12, 24	74HC573	20	20					10
U23	74HC4515N	24	24					12
U1, U2, U3, U4	MC1413	16			9		8	
U21	DS1225	28	28					14
IC DESIGNATION	TYPE	PKG	VCC +5V	VEE -5V	VDD +12V	VSS -12V	AGND	DGND

POWER DISTRIBUTION

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Consultronics
169 COLONNADE ROAD
NEPEAN, ONTARIO, CANADA
K2E 7J4
(613) 225-6087

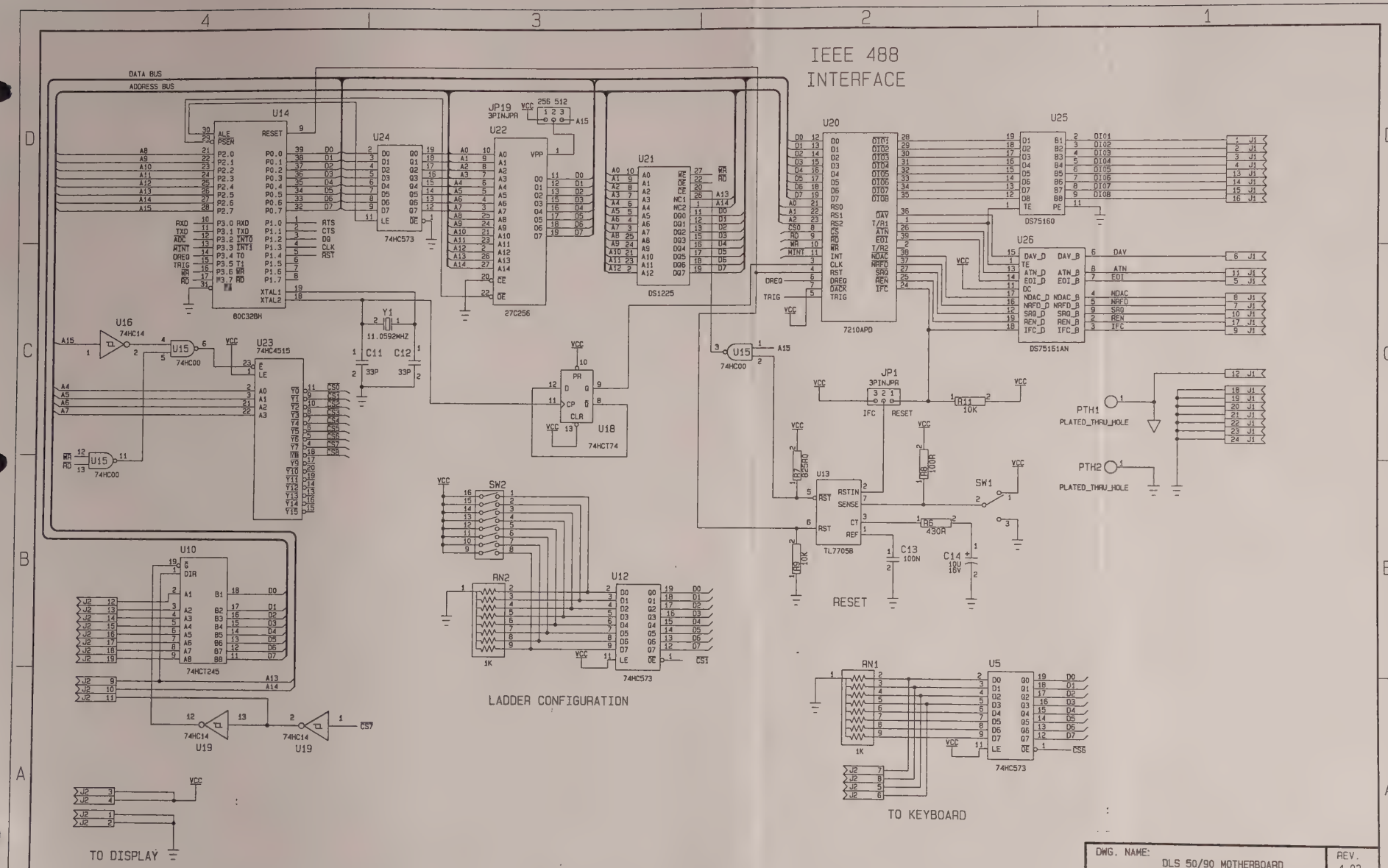
APPROVALS	NAME	YYYY.MM.DD
DESIGNED BY	J.D	92/9/18
DRAWN BY	R.L	92/9/18
REVISED BY	T.M.	1999.02.05
ECN #	3447	

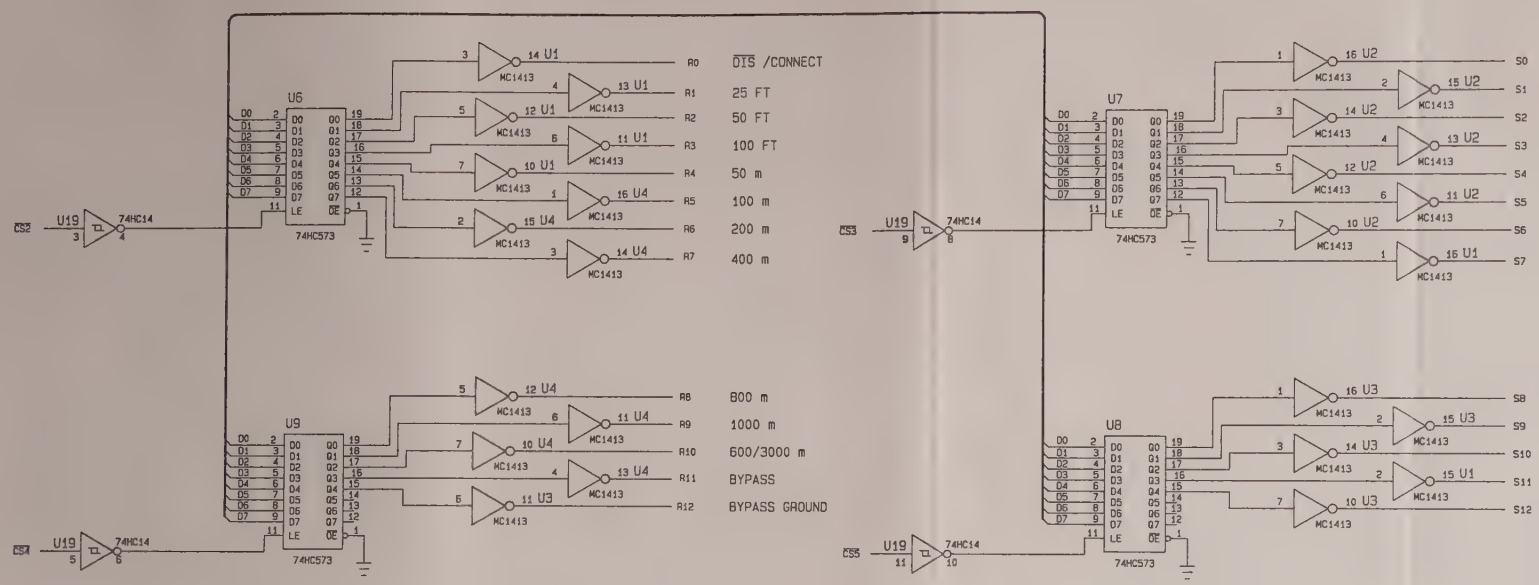
PROJECT: DLS 50/90

TITLE: DLS 50/90 MOTHERBOARD

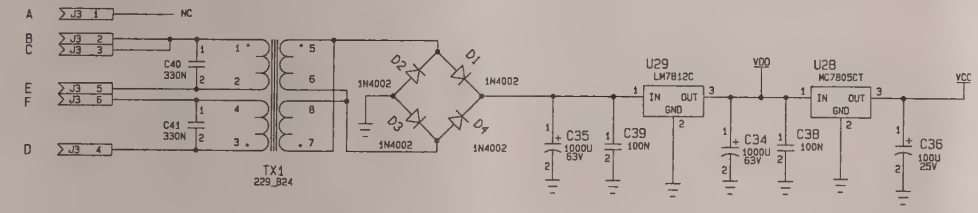
DRAWING NO: 5000-D REV: 4.02

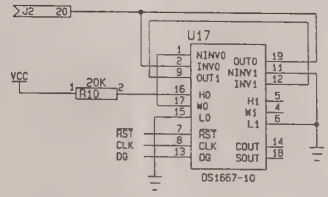
SCALE: NTS SHT 1 OF 5


IEEE 488
INTERFACE
DATA BUS
ADDRESS BUS
U14
80C32BH
U24
74HC573
U22
27C256
JP19
3PINJPR
256 512
A15
U21
DS1225
U20
7210APD
U25
DS75160
U26
DS75161AN
U16
74HC14
U15
74HC00
U23
74HC4515
Y1
11.0592MHZ
C11
33P
C12
33P
U18
74HCT74
JP1
3PIN_PR
IFC
RESET
R11
10K
PTH1
PLATED_THRU_HOLE
PTH2
PLATED_THRU_HOLE
U13
TL7705B
R7
825R
R8
100R
R6
430R
C13
100N
C14
10U
16V
R9
10K
SW1
SW2
RN2
1K
U12
74HC573
LADDER CONFIGURATION
U10
74HCT245
U19
74HC14
U19
74HC14
TO DISPLAY
RN1
1K
U5
74HC573
TO KEYBOARD
DWG. NAME:
DLS 50/90 MOTHERBOARD
REV.
4.02
SIZE: B
5000-D
SHEET 2 OF 5



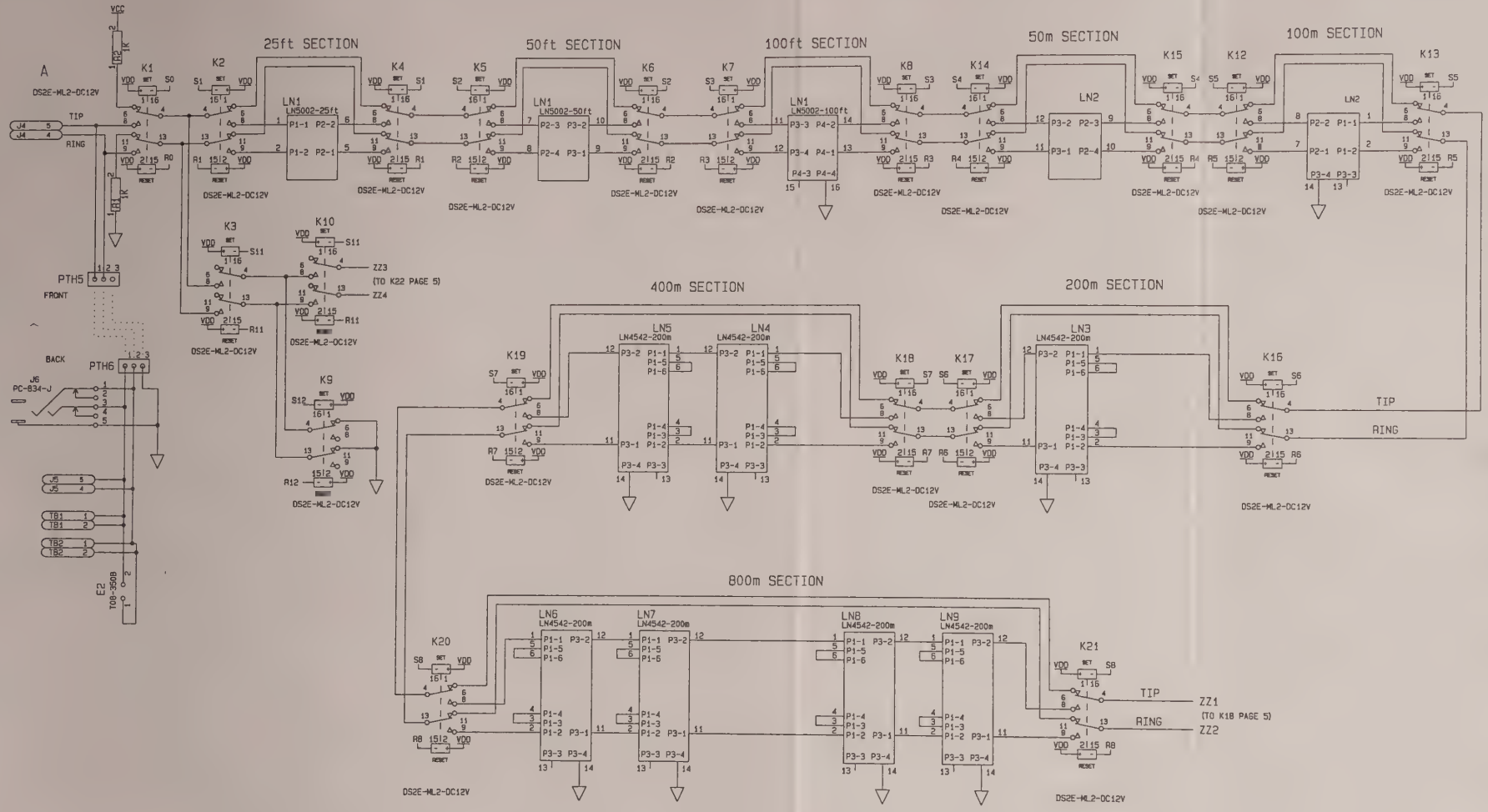
TO CORCOM FILTER





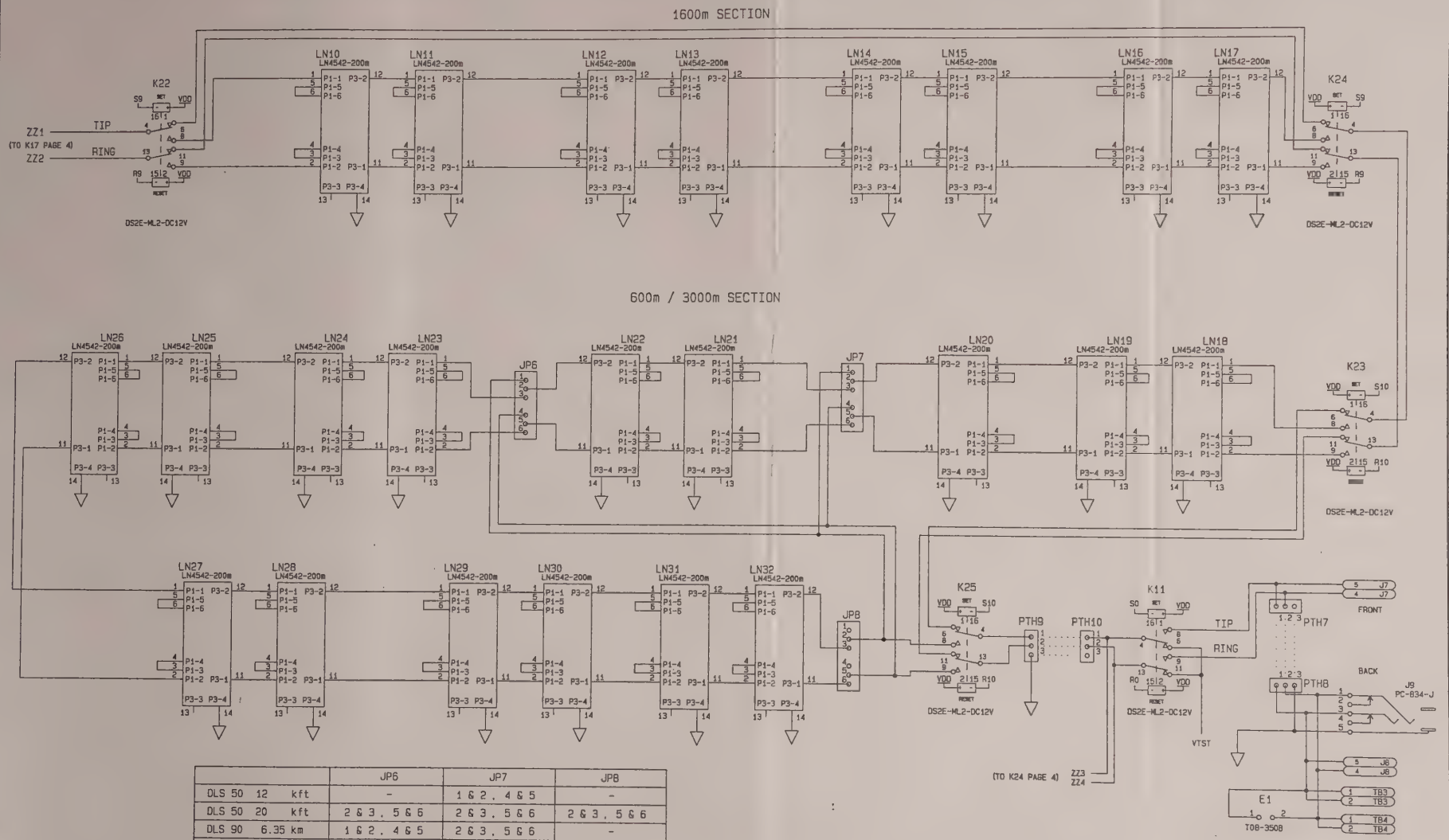
LCD CONTRAST

DWG. NAME: DLS 50/90 MOTHERBOARD		REV. 4.02
SIZE: B	5000-D	SHEET 3 OF 5



NOTE: DOTTED LINES REPRESENT SHIELDED TWISTED PAIRS.

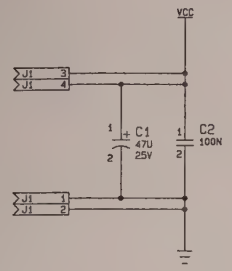
DWG. NAME: DLS 50/90 MOTHERBOARD		REV. 4.02
SIZE: B	5000-D	SHEET 4 OF 5

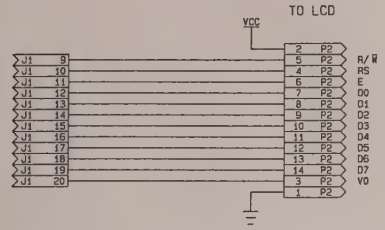


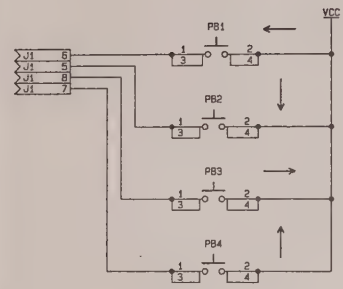
	JP6	JP7	JP8
DLS 50 12 kft	-	1 & 2, 4 & 5	-
DLS 50 20 kft	2 & 3, 5 & 6	2 & 3, 5 & 6	2 & 3, 5 & 6
DLS 90 6.35 km	1 & 2, 4 & 5	2 & 3, 5 & 6	-
DLS 90 9.35 km	2 & 3, 5 & 6	2 & 3, 5 & 6	2 & 3, 5 & 6
DLS 90 3.05 km	2 & 3, 5 & 6	2 & 3, 5 & 6	2 & 3, 5 & 6

NOTE: DOTTED LINES REPRESENT SHIELDED TWISTED PAIRS.

DWG. NAME: DLS 50/90 MOTHERBOARD		REV. 4.02
SIZE: B	5000-D	SHEET 5 OF 5







LCD	DMC4021BNY		2					1
IC DESIGNATION	TYPE	PKG	VCC +5V	VEE -5V	VDD +12V	VSS -12V	AGND	GND
POWER DISTRIBUTION								

Consultronics
159 COLONNADE ROAD
NEPEAN, ONTARIO, CANADA
K2E 7J4
(613) 225-6087

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NAME	YYYY.MM.DD	
PROJECT MGR.	J.N.E.	
DRAWN BY	T.M.	1996.11.27
ECN #	2390	
PROTOTYPE ☐	PRODUCTION ■	

PROJECT: DLS 50 / 90

TITLE: DLS 50 / 90 DISPLAY

DRAWING NO: 5001-D REV: 1.00

SCALE: NTS SHT 1 OF 1

ACCO

362 O-RING		386 O-RING
WHITE/BLANC		WHITE/BLANC
36306	5/8"	—
36316	1"	13664
36336	1 1/2"	13665
36346	2"	13666
36356	3"	13667
BLACK/NOIR		BLACK/NOIR
36307	5/8"	—
36317	1"	13674
36337	1 1/2"	13675
36347	2"	13676
—	3"	13677
		GREY/GRIS
—	1"	13684
—	1 1/2"	13685
—	2"	13686

ACCO CANADA INC.
WILLOWDALE, ONTARIO
M2H 2E2

MP MASTER
MA33477